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Balloon Rocket Blastoff

Launch into Newton's Third Law

Introduction

Have you ever watched a rocket or space shuttle soaring through the sky? How is it possible for these massive objects to move through the air? The basic principle behind rocket flight is Newton's third law of motion. In this activity, students will experiment with Newton's third law by launching balloon rockets across the classroom.

Concepts

- Newton's third law of motion
- Rocket engine thrust

Background

Newton's third law of motion states that for every action there is an equal and opposite reaction. Rockets clearly demonstrate this law. As rocket fuel burns, a great amount of heat is created and the gas pressure inside the rocket engine increases. A rocket engine is composed of strong, solid materials with a small opening at the bottom. This opening is the only region on the engine where the pressure can be released. Since gas particles move from high to low pressure, the gas shoots out the bottom of the rocket. As the fast-moving gas particles are pushed out by the rocket chamber in one direction, the gas particles push on the rocket in the opposite direction causing it to soar through the air (see Figure 1).

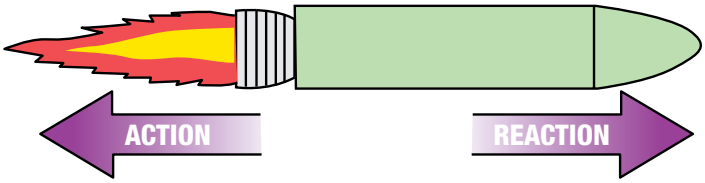

Figure 1.

Newton's third law also explains how a balloon rocket works. When you blow up a balloon, the pressure inside the balloon increases. When the balloon is released, the air is forced out the "nozzle"—the mouth of the balloon. As the air particles are pushed out by the balloon

Continued on page 2

Materials

Balloons, thin and long, 2–3
Clothespin or paper clip (to temporarily seal the balloon)
Fishing line, classroom-length (for rocket guidance)
Ruler, cm
Scissors
Straw, drinking
Support stands, 2
Tape, masking

Show How Germs Spread

Hygiene and Sterile Technique

Introduction

Infections and parasitic diseases may be spread from person to person through air, water, and physical contact. Show students how easily germs can spread and emphasize the importance of good hygiene using fluorescent lotion.

Concepts

- Disease control
- Disease prevention
- Proper hygiene
- Fluorescence

Materials

Glowing Germ fluorescent lotion
Gloves, disposable
Ultraviolet light source

Background

Contagion, causal agent, and *pathogen* are broad terms used to describe any virus, bacteria, prion (protein), protozoa, worm or genetic mutation that causes harm to living things. Most of these potential disease agents are invisible to the naked eye and also fairly widespread—the majority of surfaces are covered with both beneficial and pathogenic microbes. The type and concentration of pathogenic microbes, combined with the health and immune capabilities of the human host, determine how, when and if a person will get sick. The study of how and why people and animals become ill and how to prevent and control illness is called *epidemiology*.

Continued on page 3

What's Inside

Balloon Rocket Blastoff—Continued from page 1

in one direction, the air particles push on the inside of the balloon in the opposite direction (see Figure 2).

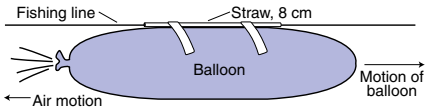

Figure 2.

Safety Precautions

Use caution when launching balloon rockets. Be sure no one is in the path of a balloon before launching it. The fishing line may be difficult to see. Be aware of your surroundings as you walk through the classroom. Do not overinflate the balloons and cause them to pop. Wear safety glasses. The latex (in balloons) may be an allergen for some individuals.

Procedure

1. Unravel fishing line to extend the length of the classroom. Leave approximately one meter of fishing line slack and then cut the fishing line with scissors.
2. Tie one end of the fishing line to a support stand. Make sure the fishing line is secure and high enough to extend parallel to the floor across the classroom without interfering with objects in the room.
3. Obtain a drinking straw and use scissors to cut the straw to approximately eight centimeters.
4. Slide the drinking straw piece onto the fishing line.

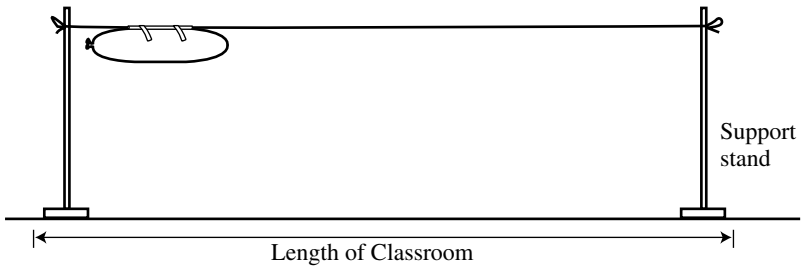

Figure 3.

5. Extend the fishing line to the opposite end of the classroom. Tie the end of the fishing line to another support stand so that the line is taut and parallel to the floor (see Figure 3).
6. Obtain a long, thin balloon. Carefully blow up the balloon to stretch it out, and then allow it to deflate.
7. Place two 5-cm pieces of masking tape on the straw piece. Place the midpoint of the tape on the straw so that the tape ends extend equally from each side of the straw (see Figure 4).
8. Inflate the balloon about ¾-full. Pinch the end of the balloon closed with fingers and twist it several times to seal the balloon, but do NOT tie a knot. Use a clothespin or paper clip to clamp the opening closed.
9. Tape the inflated balloon to the straw, making sure the balloon is balanced, the straw is lined up along the fishing line, and the straw is not crooked. Continue to pinch the opening closed with the clothespin or paper clip so no air can escape.

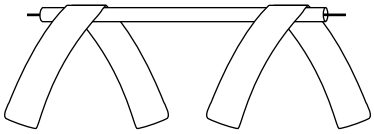

Figure 4.

10. Hold the balloon near a support stand and line up the balloon to "shoot" it straight down the fishing line.
11. When the balloon is in position, remove the clothespin and release the balloon. Do not give the balloon any extra push.
12. If the rocket does not travel all the way across the room, make necessary modifications and repeat steps 6–11. It is best to remove the original balloon and tape from the straw piece and use fresh tape and a new balloon each time.

Disposal

All materials may be thrown into the normal trash.

Tips

- For further concept development and guided inquiry on this topic, try Flinn's Balloon Rockets Student Laboratory Kit (Catalog No. AP6927) described on this page.
- The fishing line should be as taut as possible to prevent the balloon or straw from snagging the fishing line as the rocket flies across the room.
- Possible modifications to improve the range of balloon rockets include using thinner straws, such as coffee stirrers, as well as balloons of different size and shape.

Balloon Rockets Kit

Perfect for Student-Designed Experiments

It's the return of the space race! Challenge your students to build a balloon "rocket" that will travel across the classroom. This hands-on, inquiry-based lab will teach students how to design an experiment as they investigate Newton's laws of motion and rocket thrust. Students tether a balloon to fishing line stretched across the room and then must find a successful combination of orientation, drag, and thrust that will launch the balloon across the room. The task requires students to run various trials and then modify their balloon rockets based on what they learn in each trial. A fun and stimulating lab that your students will never forget! Complete instructions and enough materials for 30 students working in pairs. A balloon refill package and support stand are available and sold separately. See materials for Balloon Rocket Blastoff at the bottom of the next column.

Materials for *Balloon Rocket Blastoff* are available from Flinn Scientific

Catalog No.	Description	Price/Each
AP6927	Balloon Rocket Blastoff—Student Laboratory Kit	**$34.25**
AP6937	Balloons, Long, 5" x 24", Pkg. of 50	**9.20**
AP4550	Support Stand, Economy Choice	**9.40**

Product Spotlight

Glowing Germ Contamination

A Revealing Simulation Activity

It's amazing how fast germs can spread. Glowing Germ lotion enables you to simulate the spread of germs. In incandescent light Glowing Germ appears to be a regular hand lotion. In the presence of black light, however, the lotion fluoresces. Begin the activity by placing Glowing Germ on an object or a student's hands. Students will be amazed to see how far the contamination spreads. Turn off the classroom lights and hold an ultraviolet light close to the surfaces you are examining. Anywhere that the fluorescent lotion has been spread it will glow. Eight-ounce bottle of lotion comes with instructions and presentation tips. Ultraviolet light sold separately.

Catalog No.	Description	Price/Each
AP9080	The Glowing Germ Contamination Kit, 8 oz	**$21.95**
AP1901	Ultraviolet Lamp, Hand-Held	**33.50**
AP2075	Replacement Black Light Ultraviolet Tube, 6"	**18.35**
AP1423	Battery, AA, for Ultraviolet Lamp (Four batteries required.)	**1.85**
AP7079	Gloves, Nitrile, Disposable, Medium, Pkg of 100	**15.85**

Show How Germs Spread—Continued from page 1

Epidemiologists define an infectious disease as any disease easily transmitted by contact between a host and a victim. Contact can be direct between two individuals through kissing, hugging or shaking hands. Contact can also be indirect. In this case the contagion is transmitted by contact with an inanimate object that harbors the pathogen. These inanimate objects are called *formites*. Toys, money, kitchen sponges, cups, toothbrushes, and pencils are just a few examples of formites. Formites become infected by touch, through droplets created by coughing, sneezing, or talking, and also through airborne particles that float in the air for a long time before eventually settling on the surface of various objects.

Formites can be contagious for minutes or days, depending on the contagion. Disinfecting formites frequently, avoiding the sharing of formites, cleaning hands after touching a formite, and staying away from other people when they are (or you are) contagious are the best methods of controlling mild illnesses.

Glowing Germ lotion is a handy tool to demonstrate the spread of disease by physical contact. In incandescent light Glowing Germ appears the same as regular hand lotion. However, in the presence of a black light it fluoresces. Fluorescence only occurs in the presence of an exciting source. In this case the exciting source is an ultraviolet "black" light.

Safety Precautions

Glowing Germ is a consumer product with minimal safety hazards. Any lotion may cause skin irritation to individuals with extremely sensitive skin. Wear chemical splash goggles whenever chemicals, heat or glassware are used. Wash hands thoroughly with soap and water before leaving the laboratory. Please review current Material Safety Data Sheets for additional safety information.

Procedure

1. The use of disposable gloves is optional.
2. Place Glowing Germ on the hands of one participant. Rub it over the palms similar to hand lotion.
3. Each participant should shake hands with every other individual in the demonstration.
4. Turn off the lights so the room is dark.
5. Turn on an ultraviolet light and observe where the "germs" have spread.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* and review all federal, state and local regulations that may apply before proceeding. Place used gloves in the trash for solid waste disposal according to Flinn Suggested Disposal Method #26a.

Tips

- This demonstration may be done at the beginning of the school year to illustrate why eating or drinking in a lab setting should not be allowed and why students should always wash their hands before leaving the lab.
- The demonstration is also highly relevant in biology courses to illustrate the spread of bacteria and microorganisms and the importance of following sterile technique.
- An alternative procedure for this demonstration involves placing Glowing Germ on an object such as a door handle that will frequently be touched by students. Regular lotion can be used in other locations so it is not as obvious where the "germs" originated.
- Glowing Germ lotion is used in handwashing exercises to show rigorous washing for at least 20 seconds is needed to rinse away microbes. Place lotion on students' hands and then have them wash for varying amounts of time from 5–20 seconds before testing under black light.

Teachers always enjoy doing this fun activity at our Flinn Scientific biology workshops—and your students will enjoy it too!

Triple Beam Balance

Dependable Accuracy

Our most popular balance! The basic, mechanical design—with sliding weights on notched and tiered beams—helps students understand the weighing process. Features magnetic damping for quick weighing. Accessories sold separately include an anti-theft device (OB1059) and an attachment weight set (OB1065) which expands the capacity from 610 grams to 2610 grams. Sensitivity: 0.1 gram. 15-cm diameter platform. 5-year warranty.

See our entire selection of balances and accessories on pages 160–167 in the *2010 Flinn Science Catalog Reference Manual—Middle School Edition.*

Catalog No.	Description	Price/Each	Price (6-11)	Price (12-23)	Price (24+)
OB1040	Triple Beam Balance	**$153.00**	**$148.40**	**$143.80**	**$140.75**
OB1059	Anti-theft Device	**27.65**	—	—	—
OB1065	Attachment Weight Set	**37.00**	—	—	—

Life Characteristics

Defining Life—
Is It Living or Nonliving?

New

What features distinguish living and non-living things? If something is moving and dividing is it considered alive? Do they share any of the same characteristics? By making detailed observations and identifying patterns, students quickly realize the answer is not obvious as originally thought. This demonstration will challenge students to think about the definition of life by showing how the properties of living organisms can be imitated by a lifeless system. A great opening day demonstration to develop observation and reasoning skills!

Kit includes sufficient materials to perform the demonstration seven times.

Catalog No.	Description	Price/Each
FB1983	Life Characteristics—Biological Demonstration Kit	**$22.50**

Lab Safety Goggles

Quality and Comfort

These lab safety goggles provide comfort, protection and durability. The double flange cushion, made of soft vinyl, gently conforms to facial contours. Ventilation is provided through the covered lens channel and four covered vents.

Goggles are sized to fit over most eyeglasses. Replacement parts such as lenses, elastic head bands and vent covers are listed in our catalog. AP3306 and AP3309 meet ANSI Z87+ standards. AP3312 and AP3315 meet ANSI Z87.1 standards.

See our complete selection of eye and face protection products and accessories on pages 655–657 in the *2010 Flinn Science Catalog Reference Manual—Middle School Edition.*

Catalog No.	Description	Price/ Each	Price/Each Qty. 72–299	Price/Each Qty. 300 or more
AP3306	Standard Vented Goggles	**$6.65**	**$6.25**	**$5.30**
AP3309	Standard Vented Goggles with fog-free lens	**7.85**	**7.45**	**7.05**
AP3312	Standard Vented Goggle, Small Size	**7.95**	**7.45**	**7.15**
AP3315	Standard Vented Goggle, Small Size with fog-free lens	**9.95**	**9.35**	**8.95**

Free Fall Kit

Acceleration Lab

New

An economical way for students to test Galileo's famous hypothesis—acceleration due to gravity is independent of mass. When two steel spheres whose masses differ by a factor of 10 are dropped together, students are shocked that the balls hit the ground at the same time. Students time the free-fall drops of both the large and small sphere, and average the results to calculate the acceleration due to gravity. Use this kit to dispel the common myth that "heavier objects fall faster," and to increase your students' quantitative lab skills. Kit includes 10 large and 10 small steel ball bearings, 10 foam pads and complete instructions. Timers are required and sold separately.

Catalog No.	Description	Price/Each
AP7376	Free Fall—Student Laboratory Kit	**$39.95**
AP6396	Timers, Student, pkg. 12	**84.95**

Rubber Bones — Inquiry-Based Lab

Proof That Calcium Makes Bones Strong

Introduction
Use this inquiry-based lab activity to test for calcium in bones.

Concepts
• Bone structure • Physiology • Nutrition

Materials
Calcium carbonate, $CaCO_3$, (marble chips or limestone), 1.5 g
Sodium oxalate solution, $Na_2C_2O_4$, 1% solution, 2 mL
Vinegar, white, 6 mL
Water, distilled
Beaker, 50-mL
Beral pipets
Chicken bones, cooked (wishbone or leg bones)
Filter paper
Funnel
Graduated cylinder, 10-mL
Mortar and pestle
Stirring rod
Test tube, 16 × 100 mm

Safety Precautions
Sodium oxalate solution is slightly toxic by ingestion. Vinegar (dilute acetic acid) is a skin and eye irritant. Wear chemical splash goggles and chemical-resistant gloves, and wash hands with soap and water after the lab.

Preparation
To prepare a 1% solution from 0.1 M sodium oxalate solution, mix 59 mL of 0.1 M sodium oxalate with 41 mL of distilled or deionized water.

Procedure
I. Qualitative Test for Calcium Ions

1. Grind calcium carbonate with a mortar and pestle. Weigh 1.5 g of powder into a 50-mL beaker.
2. Add 6 mL of vinegar and stir well. Carbon dioxide gas will be evolved. Allow any remaining solid to settle.
3. Filter the liquid above the solid into a test tube. The filtrate should be clear.
4. Add several drops of sodium oxalate solution to the test tube. Formation of a white precipitate (calcium oxalate) confirms the presence of calcium.

II. Inquiry Design

After students have performed the qualitative test for calcium, ask them to design an experiment to determine if the presence of calcium in cooked chicken bones makes bones strong. Discuss the need for positive and negative controls in the experiment.

III. Sample Experiment

Positive Control

The qualitative test for calcium ions (Part I) may be used as a positive control for the experiment.

Negative Control

Cover cooked chicken bones with distilled or deionized water and allow to soak overnight. Add 2 mL of the resulting solution to a test tube and test for calcium ions. Examine the hardness of the bones. Repeat test at regular intervals for one week.

Experimental Sample

Cover the cooked chicken bones with vinegar. Let soak overnight. Add 2 mL of the resulting solution to a test tube and test for calcium ions. Examine the hardness of the bones. Repeat test at regular intervals for one week.

Disposal
Please consult your current *Flinn Science Catalog/Reference Manual—Middle School Edition* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. Vinegar and sodium oxalate may be disposed of according to Flinn Suggested Disposal Method #26b.

Discussion
Students often think that the chicken bones are simply "degraded" by soaking them in acid. Demonstrate that calcium really is removed from the bone, leaving a rubbery matrix. Students should first learn how to test for calcium by running the positive control. Then allow students to formulate a procedure that tests for the presence of calcium in chicken bones. This will help students learn experimental design.

The experiment demonstrates the reaction of calcium carbonate ($CaCO_3$) with acetic acid ($HC_2H_3O_2$) to form calcium acetate, a soluble salt. Calcium ions react with oxalate ions ($C_2O_4^{2-}$) to form a white precipitate of calcium oxalate (CaC_2O_4). This reaction is a good qualitative test for the presence of calcium ion. Calcium oxalate is insoluble in water and acetic acid.

$$CaCO_3(s) + 2HC_2H_3O_2(l) \rightarrow Ca^{2+}(aq) + 2C_2H_3O^-(aq) + CO_2(g) + H_2O(l)$$

$$Ca^{2+}(aq) + C_2O_4^{2-}(aq) \rightarrow CaC_2O_4(s)$$

Calcium can be removed from bone and reacted with the oxalate ion in the same manner.

The bones soaked in vinegar become rubbery, while the bones soaked in water remain brittle. Removing enough calcium to yield "rubber bones" takes several days. Add vinegar as needed to keep bones covered and cover the beakers to reduce evaporation. The distilled water and vinegar used in the experiment should be tested for calcium ions as a part of the negative control. *Note:* Tap water may give a positive test for calcium in some regions of the country. Use distilled or bottled water if needed.

Acknowledgment
Special thanks to Diane Burnett, Outreach Coordinator (retired), Purdue University.

Materials for *Rubber Bones* are available from Flinn Scientific

Catalog No.	Description	Price/Each
C0347	Calcium Carbonate, 100 g	$ 6.50
S0249	Sodium Oxalate Solution, 0.1 M, 500 mL	6.20
AP6066	Mortar and Pestle Set	11.65

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